

Connecting our Campus, Connecting to our Environment:
Ball State University Center for the Environment

An Honors Thesis (HONRS 499)

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Ball State University
Muncie, IN

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Abstract

The Ball State Center for the Environment, a design problem posed in the Arch 401 Cripe Competition, embodies the University's continued dedication to sustainable construction and environmental excellence. The building houses a sustainability and environmental studies library, an auditorium, classrooms and offices and contains sustainable technologies such as multiple green and habitable roofs, photovoltaic panels, a living machine, natural ventilation and daylighting and a solar water heater. These spaces provide students with an opportunity to inhabit and interact with environmentally responsible building techniques. In order to objectively assess the sustainability of my design solution, I have used the LEED (Leadership in Energy and Environmental Design) ranking system.

Acknowledgements

- I would like to thank Professor Stephen Kendall for advising me both during the Cripe Competition in the Fall of 2009 and the thesis writing process.
- I would also like to thank all the professors in the College of Architecture in Planning for their continuing commitment to sustainable design.

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Introduction and Design Overview

The Ball State Center for the environment, a design competition presented to the Arch 401 studios in the Fall of 2008, is a building presenting a multitude of challenging design opportunities. Located between two existing campus buildings, the BSCFE is a pedestrian connection between the Arts and Journalism Building and the Teacher's College, a symbol of Ball State's leadership in sustainable construction and a center for interactive education. My proposed solution is inherently a connection—a connection of students to their environmental education, a connection of existing buildings and a mental connection between all inhabitants and the practice of sustainability.

The competition provided a program for the building's spaces. The main public spaces are a library, a theater and a public lounge. My scheme places the most public, widely used spaces on the first floor—each additional floor contains increasingly private spaces. Required semi-private and private spaces include classrooms, offices, computer labs and administrative space. In total the building made up 32,193 square feet. I have included the project program in appendix A.

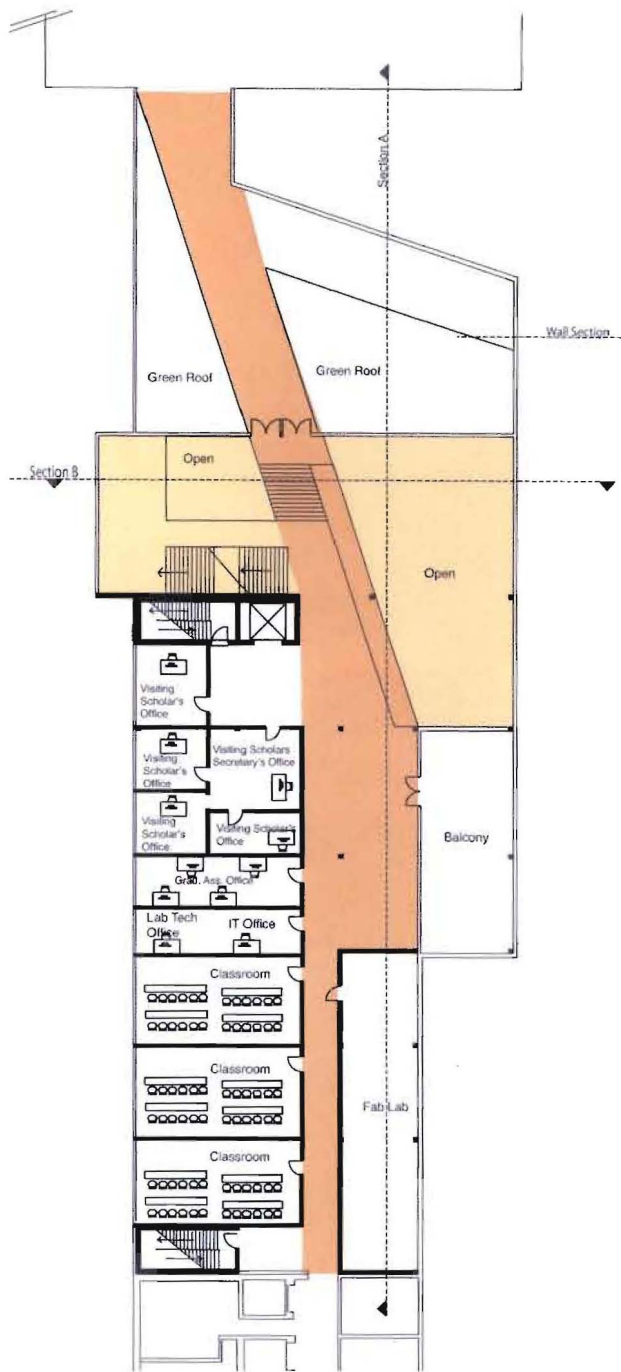
As users enter the building from the South East, they first come into the ground floor atrium. The three story atrium is the most important public space in my design because it contains the living machine, a physical symbol of Ball State's commitment to sustainability. It emphasizes the importance of the living machine to the environmental center's identity and connects students visually and experientially to the process of digesting wastewater. Ramps soar overhead, negotiating the floor height differences between the Arts and Journalism building and the Teacher's College and continuing the pedestrian connection that joins all the buildings West of McKinley Ave. On the third floor students lounge, study or eat on a combination outdoor patio and green roof, viewing the campus activity below.

As the symbol for Ball State University's cutting edge role in sustainable design (enhanced by the university's recent announcement that it will soon begin work on constructing a geothermal heating system) The Center for the Environment will lead the campus in design innovation and sustainable technologies. Sustainable techniques include a living machine, photovoltaic panels, a solar water heater, green roofs, natural daylighting, natural ventilation, a dedication to indoor environmental quality and a visual relationship between exterior and interior spaces.

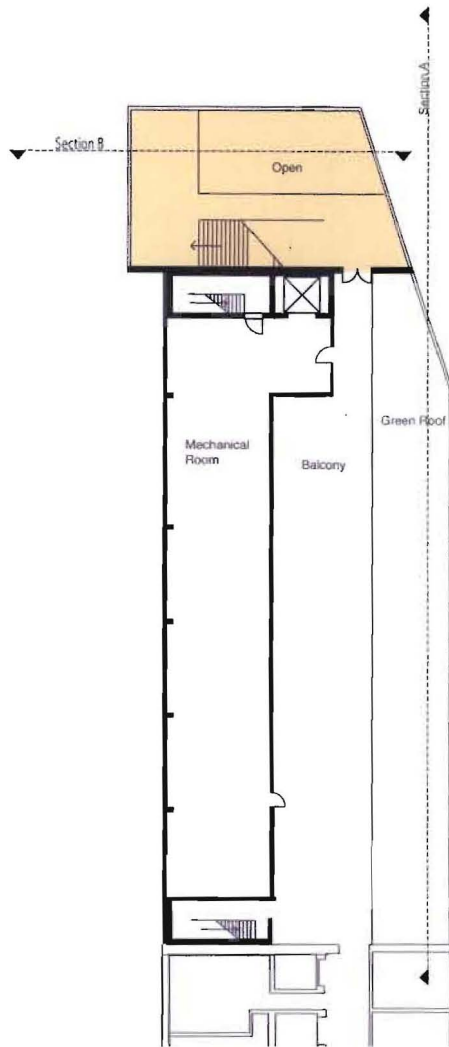
In order to judge the sustainability of this design in an objective manner I have used the LEED (Leadership in Energy and Environmental Design) point system. In Ball State's dedication to environmental excellence, all new construction must be LEED certified and earn a Silver rating or better. The Letterman

Building, designed by MSKTD Architects of Indianapolis and completed in 2007, earned a LEED silver rating. After describing each sustainable system I implemented in the design of the Ball State Center for the Environment, I will also explain the LEED credits resulting from these systems.



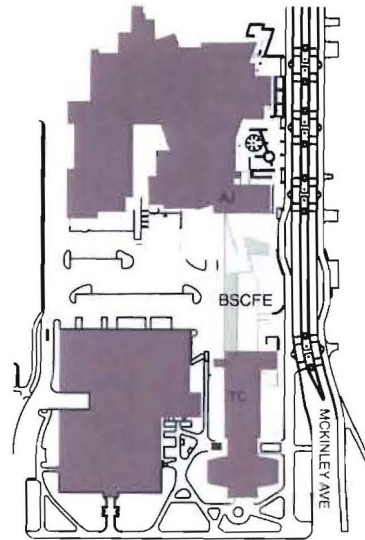


Third Floor Plan

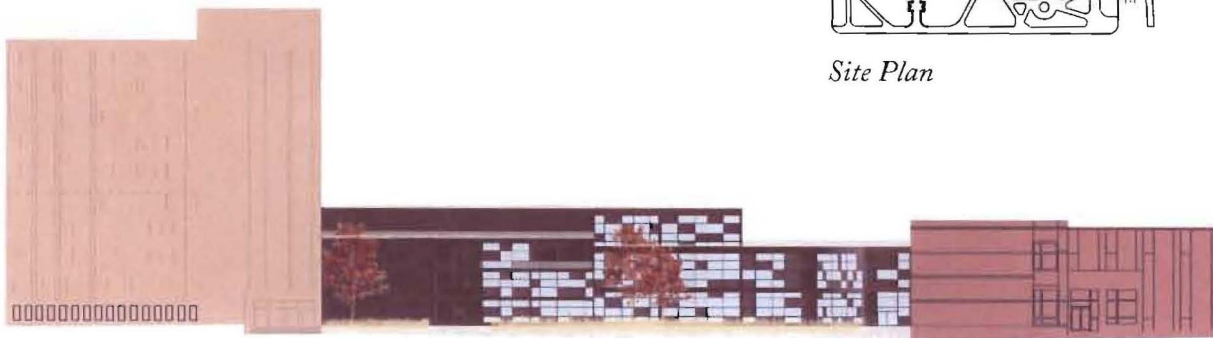


Fourth Floor Plan





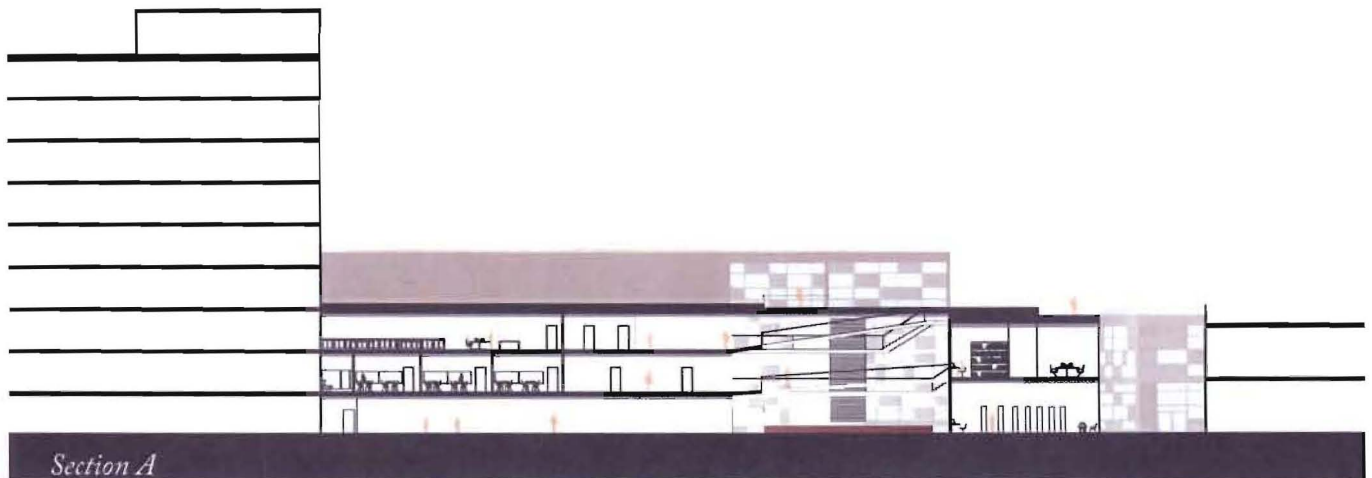
Site Plan



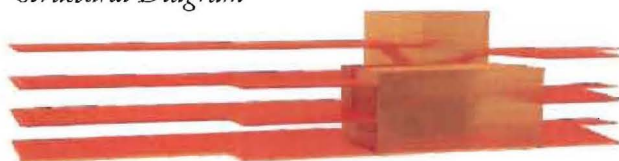
East Elevation



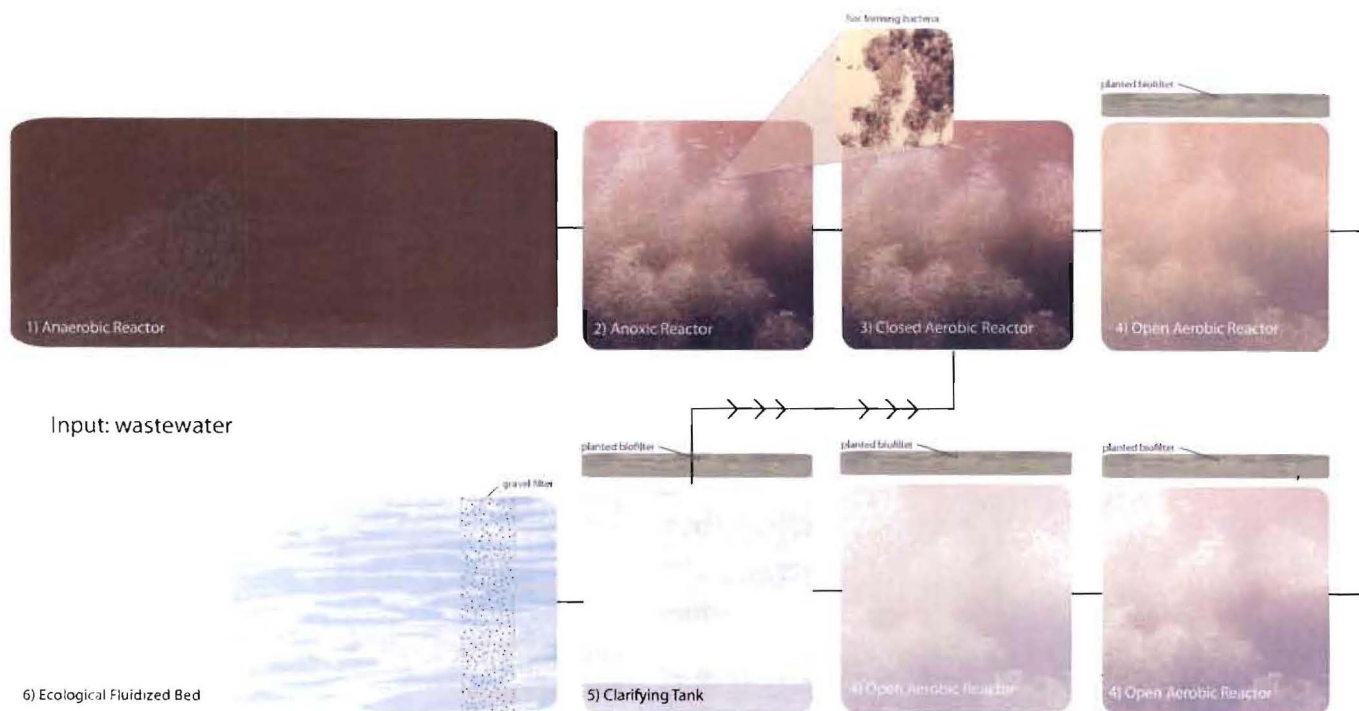
West Elevation



Section A



Architectural drawing showing a wall section and elevation switch. The left side displays a wall elevation with a grid of windows and a tree on the left. The right side shows a cross-section of the wall with structural details like rafters, insulation, and a central vertical post. Silhouettes of a person standing and a person sitting are shown inside the wall section. A scale bar and the title "WALL SECTION AND ELEVATION SWITCH" are at the bottom right.



Result: Treated Wastewater
Living Machine Diagram

The Living Machine

The living machine is the heart of the BSCFE, though in reality its function is closer to that of the kidneys. In the center of the building, the living machine's location in the main circulatory space forces inhabitants to intellectually and physically confront the water recycling process. Functionally, the living machine uses a series of aerobic and anaerobic tanks to digest human waste and grey water, cleaning and purifying water so that the end result can be used to flush toilets, water plants and take showers. In this building the living machine is also a living workshop and laboratory for students to learn about the digestion process and the maintenance of the living machine system. Overall, it is reasonable to assume based on precedent systems of similar size that this system would process approximately 3000 gallons of wastewater per day. However, since the system is proprietary to Living Machines, Inc., it is only possible to estimate the exact specifications of the system for this building.

The six tanks of the living machine each have a specific purpose in cleansing the campus's wastewater. The first step in the process is an anaerobic (non air containing) reactor. Similar to a **septic** tank in shape and size, the tank is buried below grade, as is typical. Solids entering the tank are removed with a netting system and allowed to settle to the bottom of the reactor. Anaerobic bacteria begin to digest the waste present in the tank.

Periodically, solid waste will be removed to a reed bed designed to treat biosolids. Gases produced in the tank will be vented after passing through a carbon filter, eliminating any odor.

The second step in the digestion process is an anoxic reactor, a tank that contains mixed water and air. Aeration is key to the development of “floc-forming” (EPA, 2) micro-organisms and is maintained with a bubble diffuser. Odor is controlled by a vented, planted biofilter above the reactor. The third step, a closed aerobic reactor, is also aerated with a bubble diffuser and vented with a planted biofilter. The main purpose of this tank is to digest wastewater, remove gases and begin nitrification (EPA, 3).

A series of open aerobic reactors are the next step in the process. Unlike the previous tanks, these are open to the environment, covered by vegetation resting on racks. The plants encourage growth of digestive microorganisms and absorb nutrients in the water. The number of tanks in this stage of the digestion process depends on the size and flow of wastewater; each system is designed to specifically meet the needs of its building. In the Ball State Center for the Environment, we determined that three aerobic reaction tanks are appropriate for the building’s needs based on several precedent systems of similar intake and flow (EPA, 3).

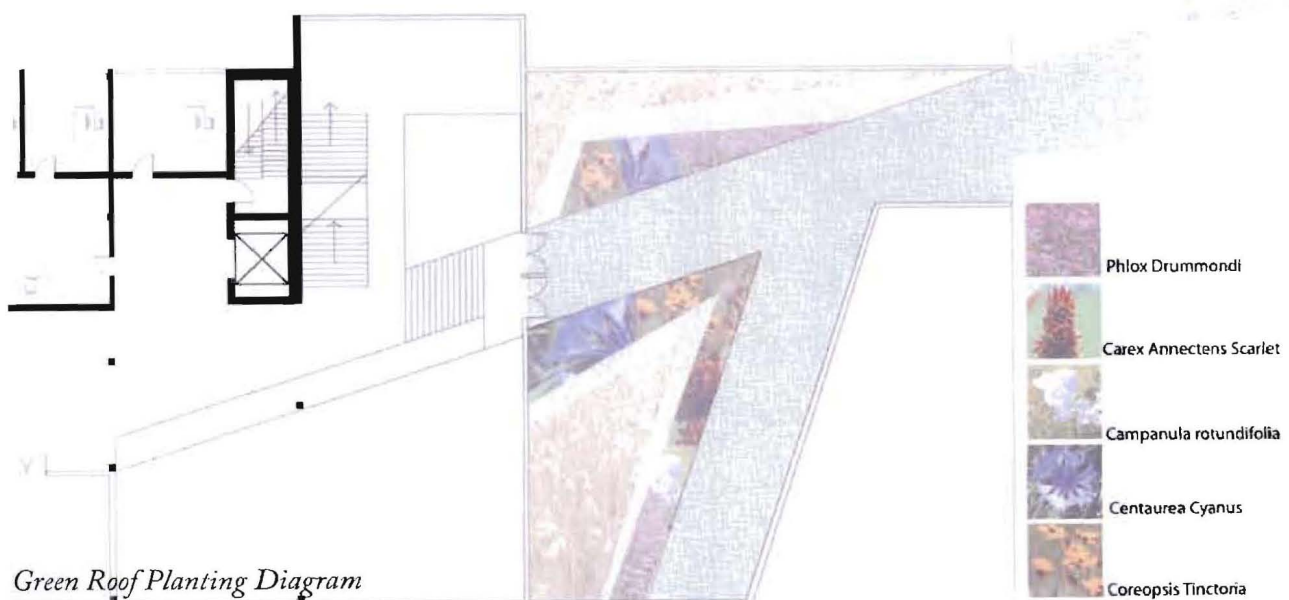
The fifth step in the digestion process is a clarifying tank. This tank allows for any remaining solids to settle. Any solids present are pumped back to step three to repeat the process until completely digested. The surface of this tank is planted to prevent the growth of algae (EPA, 3). The sixth and final step in the digestion process is an ecological fluidized bed. An aerated gravel bed traps any remaining waste particles as grey water flows through it. After the ecological fluidized bed process, the water is ready for multiple uses: flushing toilets, watering plants, safe release back into the environment or washing cars (EPA, 4).

Using the LEED accreditation model gives this project a clear guideline for assessing the sustainability of the BSCFE. Based on my research, I believe that the implementation of my living machine design would earn this project 4 LEED credits. Under the Water Efficiency Category, I believe that we would earn credit 2: “Innovative Wastewater Technologies”. By processing all the wastewater from the BSCFE and possibly the wastewater from other buildings on campus, the living machine would greatly reduce the University’s load on the Muncie Municipal sewage system. It also earns two “Water Use Reduction: 30%” credit for the grey water re-use made possible by the Living Machine. I believe I would also receive an “Innovation in Design” credit for placing the living machine in an area where students can view, interact with and learn from the system.

The Green Roof

An extensive living surface covers the majority of the roof space. Benefits of green roof systems include storm water retention, increased insulative properties and reduced heat island effect. Numerous roof patios combine with the green roof to create spaces for students to enjoy, experience and learn from the environment. The green roof construction is modular; trays containing soil, local plants and drainage systems rest above steel decking and appropriate structural support (see provided Wall Section on page 9 for structural system details). Choosing plants local to Indiana prairie environment ensures hardiness, drought-resistance and appropriateness of plant choice. Specifically, I selected *Centaurea cyanus*, *Campanula rotundifolia*, *Carex annectans*, *Coreopsis tinctoria*, *Liatris spicata*, *Phlox drummondii*, (Oaklyn Branch Library, 1). Choosing a group of plants that range from short to tall and incorporate a range of textures allows for diversity and richness in the green roof spaces. I selected plants that would bloom at various times throughout the year and that are hardy in all temperatures, to ensure that the green roof was effective throughout the year.

The space connecting to the third floor of Arts and Journalism Building to the third floor of the Center for the Environment exemplifies many of the benefits of having a green roof integrated with circulatory exterior spaces. BSCFE was designed to facilitate the connection between AJ and TC, so this space is integral to the successful use of this building. When leaving AJ on the third floor, inhabitants exit onto the roof of AJ and pass through an outdoor garden space between AJ and the third floor atrium space of the BSCFE.



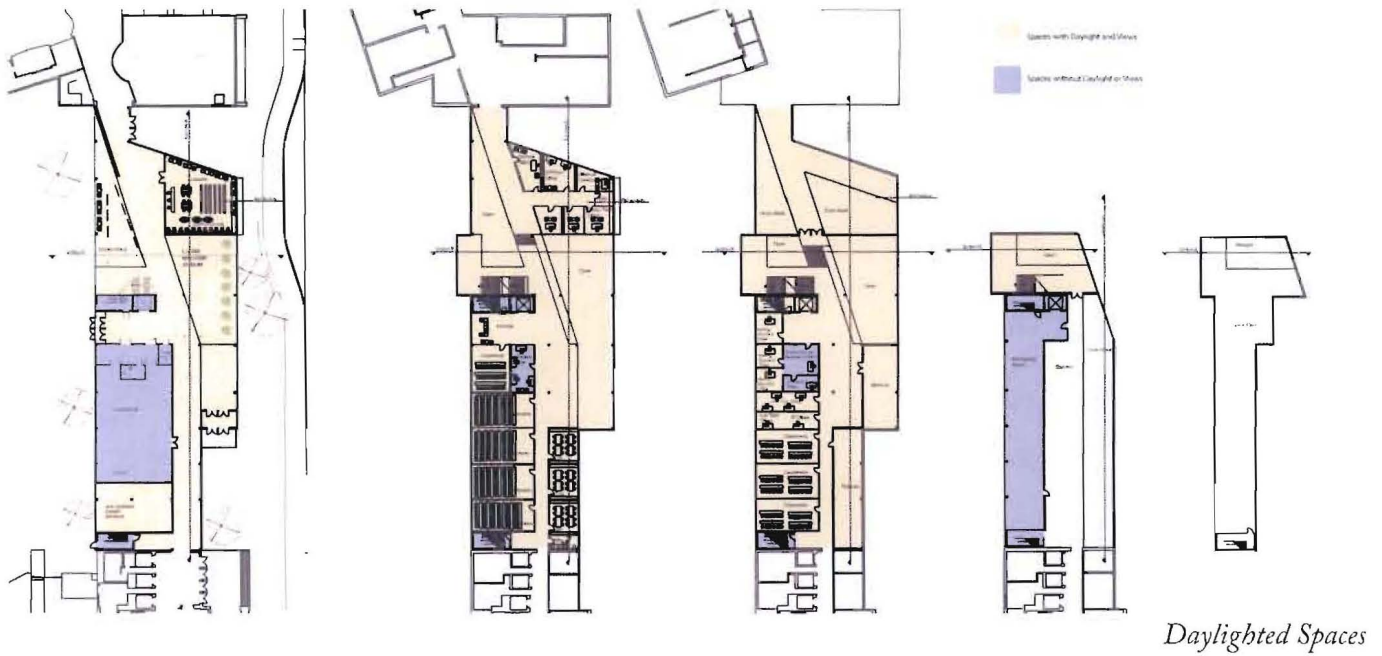
Plants line a path between the doors, engaging visitors in the technology of the green roof. The path itself is made of a permeable decking over the same modular green roof system as the rest of the green roof spaces. Plants grow through the decking, kept low by pedestrian traffic. Variations in plant choice differentiates between circulation space and landscape space. Off of the path is a larger patio space filled with benches, tables and planters. Here people can inhabit the space comfortably, studying or socializing, while the same decking material ensures that storm water runoff is sufficiently retained by the green roof. The patio space also has excellent views of the campus, visually connecting this circulation space with the busy pedestrian circulation two floors below on McKinley Avenue.

The green roof system will, I believe, earn five LEED sustainability credits. The first, in the Water Efficiency Category, is the “Water Efficient Landscaping” credit. The second is an Innovation in Design credit, earned by integrating circulation with the green roof. In the Sustainable Sites Category, the project earns the “Landscape and Exterior Design to Reduce Heat Islands: Roof” credit. A roof covered by plants greatly reduces the building’s heat gain, reducing the heat island affect common to flat topped, black roofed buildings or large expanses of concrete. The last two, also in the Sustainable Sites Category, are “Stormwater Management” credits. Stormwater will not only be effectively reduced by the green roof system, any remaining stormwater will be treated by the Living Machine before being released.

Photovoltaic Panels

As the physical symbol for sustainability on Ball State’s campus, I strove to make the BSCFE as energy efficient as possible, using as little of the current coal-produced energy. In the next 10 years, Ball State will implement a geothermal heating system, eliminating the need for the current inefficient coal-powered steam heating plant. The BSCFE will utilize the new geothermal technology when it is complete but until that time I designed the building to use as little of the current coal system as possible. Strategically placed photovoltaic panels will do much to reduce the BSCFE’s dependence on fossil fuels.

Because of the orientation of the site, long narrow and bordered on the South by the nine foot Teacher’s College, the placement of PV panels was limited. Because of the restrictions, I integrated the PV panels into the inhabitable space on the third and fourth floor green roofs. The use of photovoltaic panels in this project contributes to 13 LEED credits in the Energy and Atmosphere category-- nine for “Optomizing Energy Performance”, two for “On Site Renewable Energy” and one for implementing “Green Power” technology. With the credits already outlined in the previous sections, the projects total at this point is 22 credits.

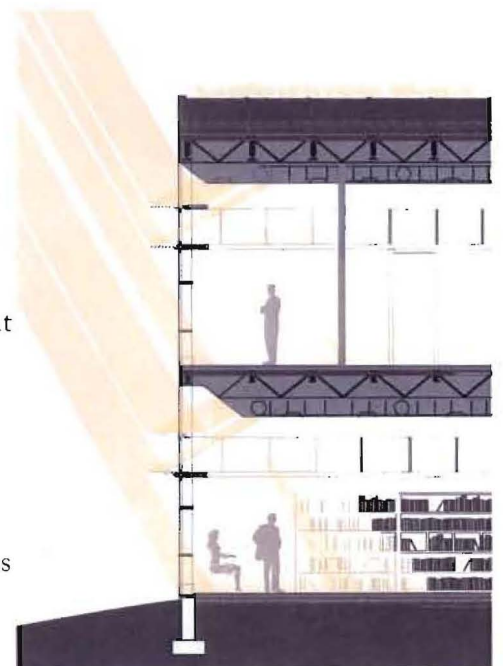


Light

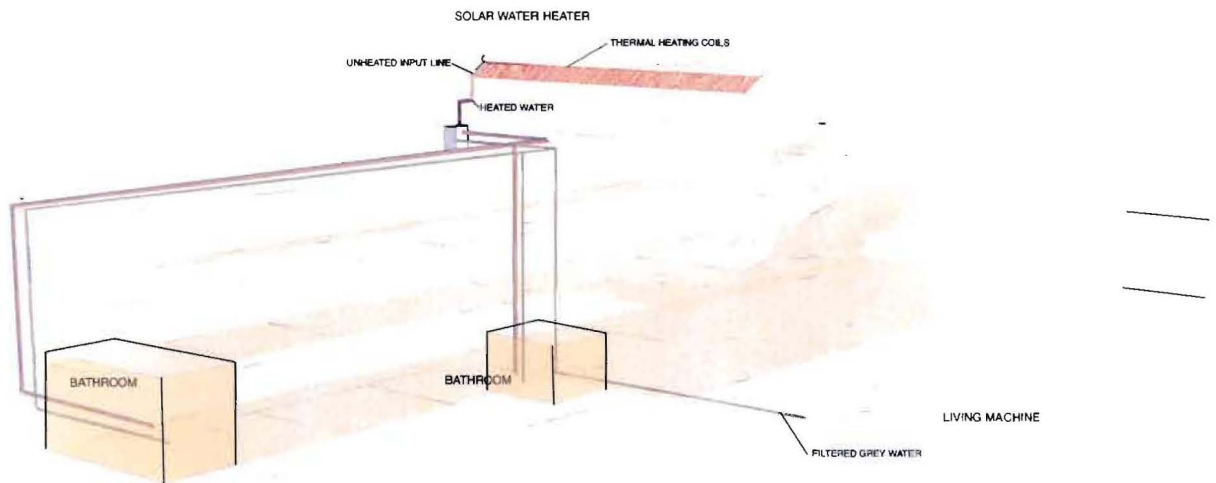
Natural daylighting techniques are used throughout the building, most notably the largest and most public spaces. West-facing windows and an overhead skylight light the atrium space, housing the living machine, the gallery and the most widely used circulation spaces. Classrooms, offices and computer lab spaces are also lit naturally through the use of energy efficient windows. My choice of glazing was guided by the insulative needs of the building and the specific views in each space.

The physical sensitivity books and the presence of a large amount of computer equipment dictates a limit to the heat gain and light in the library. A system of two light shelves reflects light into the library while blocking direct light from entering the space. They are placed to block the lowest angles of winter light, to eliminate direct glare from the west and ensure that the space is comfortable to inhabit in all seasons.

The lighting design in the Ball State Center for the Environment will, I believe, earn this design two LEED credits. Both are from the Indoor Environmental Quality section. The first is the "Daylight and Views: Daylight 75% of spaces" credit. The second is the "Daylight and Views: Views in 90% of spaces" credit. As you can see from the diagrams provided, at least 75% of the building area is lit naturally, and at least 90% percent contain views of the building's surrounding environment.



Sun Angles Diagram



Plumbing Diagram

Water

Water flows through various spaces in the building, but all water used in this building and the surrounding buildings on campus ends in the living machine. As discussed previously, the living machine digests all wastes in black water, producing grey water that can be reused for many purposes, such as flushing toilets or watering plants. The solar water heater contributes to LEED credits related to energy efficiency, already discussed in the photovoltaic panel section.

A solar water heater on the roof of the building uses thermal properties of sunlight to heat the water necessary for use in bathroom faucets. The system should be efficient enough to supply enough water for the building's needs, but is backed up by a secondary water heater should weather, temperature or demand interfere with the system's ability to meet the required hot water load. A panel of thermal collectors rest on top of the main circulation atrium; water is pumped inside, heated by the sun and drawn by convection into a large collector tank above the thermal collectors. A small electric pump services the solar collector, itself powered by PV panels located alongside the thermal collectors. The hot water is collected inside a larger tank in the adjacent mechanical room to be circulated within the building.

Natural Ventilation and Thermal Comfort

The main circulation space uses the stack effect to move air through the space, exhausting heated air and circulating fresh air with fans located near the ceiling. In summer months this system will draw cool air through the building. Operable windows in the classrooms, labs and offices allow for natural ventilation in the south

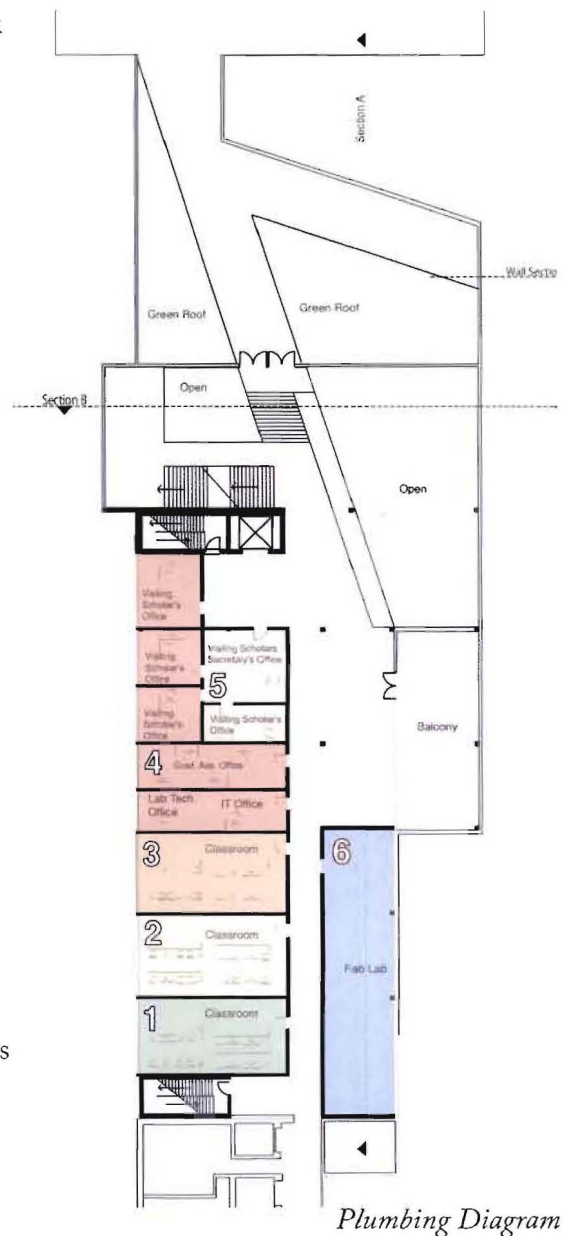
wing of the building. With the doors and windows open, the stack effect in the atrium can pull air through the entire building.

Operable windows in offices and classrooms improve the individual's experience of the space, allowing them to modify their space to suit their individual comfort zone. Additionally, the HVAC (Heating, Ventilation and Air Conditioning) system is made up of several thermal zones. Because each thermal zone contains a thermostat that controls the temperature of that space, it is much easier for the user to determine the temperature of their environment. For instance, on the second floor, there are 3 classrooms, each designed to hold 24 students, a fabrication lab, one four-person office, one two-person office and five one-person offices. In my thermal zoning design, I created six thermal zones. Each of the classrooms and the fab lab is its own thermal zone, while there are two more for the offices. The offices that do not have access to exterior ventilation and natural light (one visiting scholar's office and the visiting scholar's secretary's office) are in their own thermal zone because the thermal quality of these spaces will be much different than that of naturally lighted, naturally ventilated space. In this design, the individual long term user has control of the thermal quality of their space, shared with, at most six other people.

The natural ventilation and thermal zoning of the BSCFE earns this design four LEED credits. All are in the Indoor Environmental Quality category. They are "Increased Ventilation", "Thermal Comfort, Design", "Thermal Comfort, Ventilation" and "Controllability of Systems, Ventilation".

Conclusion and LEED Overview

The Ball State Center for the Environment embodies the university's commitment to sustainable construction. It is both a environment for learning and a physical teaching tool, containing many opportunities for immersive learning in the function and maintenance of sustainable building techniques. Through the



design of this facility, I expanded and deepened my knowledge of green technology, architectural programming, structural and environmental systems.

Through the design of sustainable systems such as a living machine, green roof, photovoltaic panels, solar water heater, natural ventilation and daylighting and attention to indoor environmental quality, it is my belief that the Ball State Center for the Environment would earn 50 LEED credits, a Gold rating. This would place it among the most sustainable buildings in the country and solidify Ball State's position as a leader in education and sustainability.

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Appendix A

Cripe Competition Guidelines

DEPARTMENT OF ARCHITECTURE
College of Architecture and Planning
Ball State University
Muncie, Indiana

Architecture 401 25 August 2008

Professors Bilello, Chiuini, Fisher, Kendall, Swartz and Wyman

A BALL STATE UNIVERSITY CENTER FOR THE ENVIRONMENT
A Design Competition Sponsored and Funded by Cripe Architects + Engineers

I. INTRODUCTION

For this, your last scheduled design experience in your undergraduate course of study at Ball State, you will be presented with a trifurcated set of challenges/ opportunities. These are:

- The opportunity to design a building that has urban design response and environmental response as key aspects of the design problem. The urban design response relates to the necessity to interpret the design vocabularies of the contiguous buildings as well as those of the campus as a whole and creation of a vocabulary for the building in response to that interpretation. The environmental response requires the design consideration of those many aspects that live under the rubric of "sustainability": e.g., water harvesting, storm water management (green roof, retention pond, detention pond, cistern, treatment), on-site black water treatment, solar thermal management (useful collection and avoided overheating), cross ventilation, stack ventilation, PV electrical production, energy flow balances and mechanical system(s) type(s).
- The challenge of a Cripe Architects + Engineers design competition that provides you with another opportunity to present your design solution for judgment in the absence of your presence and elucidation.
- The opportunity, probably your first opportunity, to comprehensively explore the technical infrastructure of your design. The elements of this "Comprehensive Project" as defined by the National Architectural Accrediting Board are listed in an attachment to the course syllabus

Adding to the complexity of the above set of challenges is that presented by the configuration of the site and of the Teachers College building to the south of the site. The site is elongated in the north-south direction, not an orientation normally considered ideal for solar access, but it can become ideal with inventive solutions. And, the ten story Teachers College building casts a solar shadow over the site for the middle part of the day.

The result is a design problem replete with opportunities for inventive and interesting solutions.

II. THE CONTEXT

The building will be a linkage between the Art and Journalism building and the Teachers College building, thus providing the opportunity for the continuation of the internal “street” that begins at the Bell Building and now terminates with the Art and Journalism building.

It will house programs and facilities focused on environmental education, research and monitoring. In December of 2006, President Gora joined with eleven other members of the Leadership Circle of presidents and chancellors of colleges and universities as a signatory to the American College & University Presidents Climate Commitment (ACUPCC). A goal of the ACUPCC is to, “exercise leadership in their communities and throughout society by modeling ways to minimize global warming emissions, and by providing the knowledge and the educated graduates to achieve climate neutrality”. This building will be a visible manifestation of that commitment. As such, it will provide facilities for:

- Environmental education programs such as the university’s Clustered Minors in Environmentally Sustainable Practices as well as other environmentally focused education offered by units across the university.
- Environmentally-focused research and symposia
- Offices for the Center Director ,the University Sustainability Coordinator and other persons involved in campus environmental quality initiatives

The overarching goal of center is to encourage education and research and to provide campus leadership in the issues subsumed under the rubric of “environment quality” and the many interrelations of these issues within human society. The Center will draw its strength from faculty members and students across the University who make up an intellectual community of teachers and scholars in diverse fields including architecture, biology, business, earth and planetary sciences, economics, government, landscape architecture, natural resources, public health and urban planning as well as visiting scholars with expertise in areas focused on the quality of the environment. The most pressing problems facing our natural environment are complex, often requiring collaborative investigation by scholars versed in different disciplines. By connecting scholars and practitioners from different disciplines, the Center for the Environment seeks to raise the quality of environmental research and education at Ball State University and beyond.

III. TABLE OF ACCOMMODATION

The building will accommodate the following uses and spaces:

1.0	Multi-Use Suite	4,000 sq. ft.
	These spaces will be used during the day for lectures for large classes, for evening banquets, for evening lectures by prominent “environmentalists” and for plenary sessions for symposia.	
1.1	Auditorium (Seating for 150 in chairs or for 64 at tables of eight for dining)	1200 sq. ft.
1.2	Stage Area	640 sq. ft.
1.3	Stage Activity Prep Area (Quasi-Green Room)	240 sq. ft.
1.4	Meals Serving Area (For catered meals brought by truck)	320 sq. ft.
1.5	Storage for Tables and Chairs	320 sq. ft.

1.6	A-V Room (For "state of the art" A-V)	360 sq. ft.
1.7	Coat Room (For 150 coats)	120 sq. ft.
1.8	Reception Area (Outside of the auditorium: can be combined with an atrium or other common space)	800 sq. ft.
2.0	Exhibit Suite	1,440 sq. ft.
2.1	Exhibit space	1200 sq. ft.
2.2	Exhibit storage	240 sq. ft.
3.0	Library	1,200 sq. ft.
4.0	Classrooms	2,880 sq. ft.
4.1	Four classrooms @ 240 sq. ft. (Capacity: 24 ea.)	960 sq. ft.
4.2	Four classrooms @ 480 sq. ft. (Capacity: 48 students ea.)	1,920 sq. ft.
	These classrooms will be used as break-out rooms during symposia	
5.0	Laboratories	1,920 sq. ft.
	Four laboratories @ 480 sq. ft. (Capacity: 24 students ea)	
6.0	Model Fabrication Suite	600 sq. ft.
6.1	Fabrication area One routing machine and two laser cutting machines	480 sq. ft.
6.2	Technician's Office	120 sq. ft.
7.0	Computer Lab	960 sq. ft.
	24 Stations	
8.0	Director's Office Suite	480 sq. ft.
8.1	Director's Secretary plus waiting area	240 sq. ft.
8.2	Director's Office	240 sq. ft.
9.0	General Office Suite	2,000 sq. ft.
9.1	General Office (One secretarial position, plus areas for copying and storage and waiting seating)	360 sq. ft.
9.2	Office for Campus Sustainability Coordinator	180 sq. ft.
9.3	Two person office for Coordinator of Clustered Minors in Environmentally Sustainable Practices and Coordinator of "Green" Initiatives	180 sq. ft.
9.4	Technician's Offices	
9.41	"Living Machine" Technician	120 sq. ft.
9.42	Computer Technician	120 sq. ft.
9.43	General Laboratories Technician	120 sq. ft.
9.5	Four person office for graduate assistants	360 sq. ft.
9.6	Conference Room for eight w/ Kitchenette	360 sq. ft.
9.7	General Storage	120 sq. ft.
9.8	Unisex disabled-accessible toilet	80 sq. ft.
10.0	Visiting Scholars Office Suite	2,000 sq. ft.

10.1	Four Offices for Four Visiting Scholars (4 @ 360 sq. ft.)	1,440 sq. ft.
10.2	Four person office for graduate assistants	360 sq. ft.
10.3	Secretary for the Visiting Scholars	200 sq. ft.
11.0	Lounge Seating at tables for 24 and a concession area with hot and cold drink machines and a microwave station (No food machines)	600 sq.ft.
12.0	"Living Machine" Suite ("Living Machine" is more accurately titled, a "Solar Aquatic System")	1,560 sq. ft
12.1	"Living Machine"	1,200 sq. ft.
12.2	"Living Machine" controls and monitoring	360 sq. ft.
13.0	Toilets (Disabled Accessible) These toilets are intended to serve the entire facility, but if the organization of the facility makes one set of toilets impractical, an additional set should be provided. Also, a drinking fountain is often located in the area of the toilets.	440 sq. ft.
13.1	Men's toilet	200 sq. ft.
13.2	Women's toilet	240 sq. ft.
14.0	Janitors' Closet This facility is often located in proximity to toilets. It contains a janitor's sink and cleaning equipment and supplies.	120 sq. ft.
15.0	General Storage Area	240 sq. ft.
16.0	Total of Above Spaces	20,440 sq. ft.
17.0	Grossage at 50% of the subtotal (This is not a programmed space, but an area allowance for corridors, stairs, elevators, wall thicknesses, etc.)	10,220 sq ft.
18.0	Total Occupied Area	30,660 sq. ft.
19.0	Mechanical Room at 5% of the Total	1,533 sq. ft.
20.0	TOTAL BUILDING AREA	32,193 sq. ft.
21.0	Service Dock and Entrance It is assumed that—as was the case with the Letterman Building—because the linked-to buildings on either side have docks, received materials will come into, and discarded materials will go out of, the building through one of these two docks.	

22.0 Outdoor Spaces

Due to the nature of this building, it would seem appropriate for a number of the spaces to have contiguous outdoor—or quasi-outdoor—areas. Most likely of these are the multi-purpose room, the classrooms and the offices. But these outdoor spaces, if included, must be provided within the boundaries of the site.

However, because the site abuts the existing parking lot on its west edge, an area 35' in width for 125' of the northern half of north-south length of the site has been allocated to this building to be designed as a landscaped buffer between it and the parking lot. The remaining 125' must be kept clear of planting to allow access to the Teachers College building loading dock, but the paving material may be replaced. The design of that area will be the responsibility of the building designer.

Moreover, the area between the east edge of the site and the McKinley Avenue sidewalk can be repaved and/or re-landscaped, but the current sidewalk pavement and configuration must remain unchanged.

IV. THE SITE

1.0 Site Location and Dimensions

The site for the building will be an 85' x 250' area between the Art and Journalism building and the Teachers College building. The 85' east-west dimension has as its east edge the extension of the line of the east face of the southeast block of AJ and as its west edge the extension of the west face of the main block of TC. (An outline plan showing site dimensions will be distributed)

2.0 Parking

There will be no automobile parking requirement for this building. However, bicycle racks will be provided.

3.0 Utilities Access

For the purpose of this design exercise, the assumption can be made that all utilities with the exception of potable water—data, chilled water, natural gas, power, steam and telephone—will come from a utility tunnel along McKinley Avenue. Potable water will come underground from the west.

4.0 Subgrade Use

Subgrade water conditions preclude placing any parts of the building, except a utility tunnel, or utility tunnels, below grade.

Appendix B

LEED Project Checklist



LEED for New Construction v 2.2

Registered Project Checklist

Project Name: Ball State Center for the Environment-- Cripe Design Competition Fall 2008

Project Address: Ball State University

Yes	?	No		
50	0	0	Project Totals (Pre-Certification Estimates)	
GOLD			69 Points	
			Certified: 26-32 points Silver: 33-38 points Gold: 39-51 points Platinum: 52-69 points	

Yes	?	No		
13		0	Sustainable Sites	
			14 Points	

Yes			Prereq 1	Construction Activity Pollution Prevention	Required
1			Credit 1	Site Selection	1
1			Credit 2	Development Density & Community Connectivity	1
		0	Credit 3	Brownfield Redevelopment	1
1			Credit 4.1	Alternative Transportation, Public Transportation	1
1			Credit 4.2	Alternative Transportation, Bicycle Storage & Changing Rooms	1
1			Credit 4.3	Alternative Transportation, Low-Emitting & Fuel Efficient Vehicles	1
1			Credit 4.4	Alternative Transportation, Parking Capacity	1
1			Credit 5.1	Site Development, Protect or Restore Habitat	1
1			Credit 5.2	Site Development, Maximize Open Space	1
1			Credit 6.1	Stormwater Design, Quantity Control	1
1			Credit 6.2	Stormwater Design, Quality Control	1
1			Credit 7.1	Heat Island Effect, Non-Roof	1
1			Credit 7.2	Heat Island Effect, Roof	1
1			Credit 8	Light Pollution Reduction	1

Yes	?	No		
4		0	Water Efficiency	
			5 Points	

1			Credit 1.1	Water Efficient Landscaping, Reduce by 50%	1
		0	Credit 1.2	Water Efficient Landscaping, No Potable Use or No Irrigation	1
1			Credit 2	Innovative Wastewater Technologies	1
1			Credit 3.1	Water Use Reduction, 20% Reduction	1
1			Credit 3.2	Water Use Reduction, 30% Reduction	1



LEED for New Construction v 2.2 Registered Project Checklist

Yes	?	No		
12	0		Energy & Atmosphere	17 Points

Yes	Prereq 1	Fundamental Commissioning of the Building Energy Systems	Required
Yes	Prereq 1	Minimum Energy Performance	Required
Yes	Prereq 1	Fundamental Refrigerant Management	Required

***Note for EAc1:** All LEED for New Construction projects registered after June 26, 2007 are required to achieve at least two (2) points.

9			Credit 1	Optimize Energy Performance	1 to 10
			Credit 1.1	10.5% New Buildings / 3.5% Existing Building Renovations	1
			Credit 1.2	14% New Buildings / 7% Existing Building Renovations	2
			Credit 1.3	17.5% New Buildings / 10.5% Existing Building Renovations	3
			Credit 1.4	21% New Buildings / 14% Existing Building Renovations	4
			Credit 1.5	24.5% New Buildings / 17.5% Existing Building Renovations	5
			Credit 1.6	28% New Buildings / 21% Existing Building Renovations	6
			Credit 1.7	31.5% New Buildings / 24.5% Existing Building Renovations	7
			Credit 1.8	35% New Buildings / 28% Existing Building Renovations	8
			--> Credit 1.9	38.5% New Buildings / 31.5% Existing Building Renovations	9
			Credit 1.10	42% New Buildings / 35% Existing Building Renovations	10
2			Credit 2	On-Site Renewable Energy	1 to 3
			Credit 2.1	2.5% Renewable Energy	1
			--> Credit 2.2	7.5% Renewable Energy	2
			Credit 2.3	12.5% Renewable Energy	3
	0		Credit 3	Enhanced Commissioning	1
	0		Credit 4	Enhanced Refrigerant Management	1
	0		Credit 5	Measurement & Verification	1
1			Credit 6	Green Power	1



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Yes	?	No		
8	0		Materials & Resources	13 Points

Yes					
	0		Prereq 1	Storage & Collection of Recyclables	Required
	0		Credit 1.1	Building Reuse , Maintain 75% of Existing Walls, Floors & Roof	1
	0		Credit 1.2	Building Reuse , Maintain 95% of Existing Walls, Floors & Roof	1
	0		Credit 1.3	Building Reuse , Maintain 50% of Interior Non-Structural Elements	1
1			Credit 2.1	Construction Waste Management , Divert 50% from Disposal	1
1			Credit 2.2	Construction Waste Management , Divert 75% from Disposal	1
0	0		Credit 3.1	Materials Reuse , 5%	1
0	0		Credit 3.2	Materials Reuse , 10%	1
1			Credit 4.1	Recycled Content , 10% (post-consumer + 1/2 pre-consumer)	1
1			Credit 4.2	Recycled Content , 20% (post-consumer + 1/2 pre-consumer)	1
1			Credit 5.1	Regional Materials , 10% Extracted, Processed & Manufactured	1
1			Credit 5.2	Regional Materials , 20% Extracted, Processed & Manufactured	1
1			Credit 6	Rapidly Renewable Materials	1
1			Credit 7	Certified Wood	1

Yes	?	No		
11			Indoor Environmental Quality	15 Points

Yes					
Yes			Prereq 1	Minimum IAQ Performance	Required
			Prereq 2	Environmental Tobacco Smoke (ETS) Control	Required
			Credit 1	Outdoor Air Delivery Monitoring	1
			Credit 2	Increased Ventilation	1
			Credit 3.1	Construction IAQ Management Plan , During Construction	1
			Credit 3.2	Construction IAQ Management Plan , Before Occupancy	1
1			Credit 4.1	Low-Emitting Materials , Adhesives & Sealants	1
1			Credit 4.2	Low-Emitting Materials , Paints & Coatings	1
1			Credit 4.3	Low-Emitting Materials , Carpet Systems	1
1			Credit 4.4	Low-Emitting Materials , Composite Wood & Agrifiber Products	1
1			Credit 5	Indoor Chemical & Pollutant Source Control	1
1			Credit 6.1	Controllability of Systems , Lighting	1
1			Credit 6.2	Controllability of Systems , Thermal Comfort	1
1			Credit 7.1	Thermal Comfort , Design	1
1			Credit 7.2	Thermal Comfort , Verification	1
1			Credit 8.1	Daylight & Views , Daylight 75% of Spaces	1
1			Credit 8.2	Daylight & Views , Views for 90% of Spaces	1



LEED for New Construction v 2.2

Registered Project Checklist

Yes	?	No		
2		0	Innovation & Design Process	
			5 Points	
1			Credit 1.1 Innovation in Design: Provide Specific Title	1
1			Credit 1.2 Innovation in Design: Provide Specific Title	1
0		0	Credit 1.3 Innovation in Design: Provide Specific Title	1
0		0	Credit 1.4 Innovation in Design: Provide Specific Title	1
		0	Credit 2 LEED® Accredited Professional	1